

**A SUPPLEMENTARY STUDY
OF PATRONAGE FORECASTS FOR AN
EXTENSION OF *path*
TO RARITAN, NEW JERSEY**

PREPARED FOR
THE STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION
AND
THE PORT OF NEW YORK AUTHORITY

by
Wilbur Smith and Associates

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March 31, 1972

The State of New Jersey
Department of Transportation
1035 Parkway Avenue
Trenton, New Jersey 08625

The Port of New York Authority
111 Eighth Avenue
New York, New York 10011

Subject: Patronage Forecasts for an Extension of PATH
via Newark Airport to Raritan, New Jersey

Gentlemen:

We are pleased to submit herewith this supplement to our report of December 31, 1971 entitled "An Engineering Study of an Extension of PATH via Newark Airport to Elizabeth and West on the Central Railroad of New Jersey."

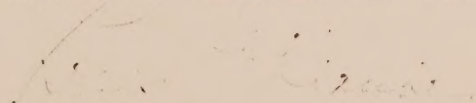
This supplementary report was prepared by Wilbur Smith and Associates who developed the patronage forecasts based on our proposed fare structure, operating schedules and level of service.

We are grateful to staff members of the Port of New York Authority for assistance in providing the population growth data, air passenger forecasts and Trans-Hudson traffic projections upon which the forecasts of PATH patronage are based.

We appreciate this additional opportunity to assist in the investigation of transportation improvements for the Newark area.

Yours very truly,

LOUIS T. KLAUDER AND ASSOCIATES


Louis T. Klauder

LTK/bld

TABLE OF CONTENTS

<u>Title</u>	<u>Page No.</u>
Introduction	1
Data Sources	2
General Study Approach	2
Area Served by PATH Extension	2
Proposed PATH Extension Operational Assumptions	3
Fares	4
Operating Schedules	4
Running Times	5
Summary of Cranford Extension Forecasts	6
Newark Airport PATH Patronage for Raritan Extension	7
Air Passengers	7
Airport Visitors	8
Airport Employees	9
Trans-Hudson Travel	10
Estimated Future Trans-Hudson Travel	11
Intra-New Jersey Travel	12
Estimated Future Intra-New Jersey PATH Travel	12
Summary of Estimated PATH Extension Patronage	14
Projected Line and Stations Volumes	14
Termination of the PATH Extension at Dunellen	17
Comparison of Patronage Forecasts	17

Introduction

This is the second part of a two-part study analyzing ridership potential of extending the Port Authority Trans-Hudson (PATH) rail system. Ridership implications of replacing the existing Central Railroad of New Jersey (CNJ) mainline services with an extended PATH system to Raritan, New Jersey have been evaluated. Objectives of the study are to assist in determining whether additional engineering feasibility analyses are warranted for this proposed amalgamation of rail services in northern New Jersey.

In addition to patronage forecasts for extending PATH to Raritan, an estimate has been made of the impact of terminating the extension at Dunellen. It is assumed in forecasting for both alternatives that all CNJ mainline operations will be discontinued in the future.

The initial phase of the study involved forecasts of patronage for an extension of PATH to Cranford, New Jersey via Newark Airport. The route selected, as well as assumed station stops, running times, and fares developed for the subject line between Newark and Cranford, were used in this second study. Beyond Cranford, assumed travel times, headways, station locations, and fare levels and structure, were provided by Louis T. Klauder and Associates.

Forecasting models developed in the initial study in combination with trend analysis methods were used in analyzing ridership potential. To facilitate forecasts, modifications to travel time and cost networks were made reflecting the proposed rail facility changes.

In addition to replacing CNJ mainline services, existing Jersey Central rail service between Cranford and Bayonne is assumed to be replaced by PATH between Cranford and Elizabeth stations.

Data Sources

In recent years, there have been a number of origin-destination surveys conducted, results of which have been used as input data in the current model development. These include the 1963-1964 Tri-State home interview survey, the 1967-1968 Newark Airport domestic in-flight survey, and surveys of travelers using the various Trans-Hudson facilities conducted by the Port of New York Authority in 1968 and prior years. Various reports and publications regarding travel patterns in the study area were evaluated.

General Study Approach

Due to different modal choice characteristics, separate analysis methods were used for each of the four market segments identified in the previous phase as possible PATH riders. These market segments are:

1. Newark Airport air passengers;
2. Newark Airport employees;
3. Trans-Hudson travelers; and,
4. Intra-New Jersey travelers.

Area Served by PATH Extension

The corridor was expanded to include a larger market area. For trans-Hudson travelers the market area in New Jersey constitutes most of Union and Somerset Counties and several municipalities in Middlesex County. Portions of Union County not considered part of the PATH extension market area due to superior alternative transit services are municipalities of Rahway, New Providence, Summit, and Berkeley Heights. Bernards, Bedminster, Far Hills, Bernardsville and Peapack Gladstone are Somerset County communities not considered part of the PATH market area. Communities in Middlesex County potentially served by the PATH

extension include Dunellen, Middlesex, South Plainfield, and Piscataway. Although trans-Hudson travelers from outside the study corridor will be able to transfer to PATH at Elizabeth from the CNJ Shoreline and Penn Central Railroads, very few are expected to do so, since transferring to PATH at Newark will provide these passengers with travel time, cost, and headway advantages.

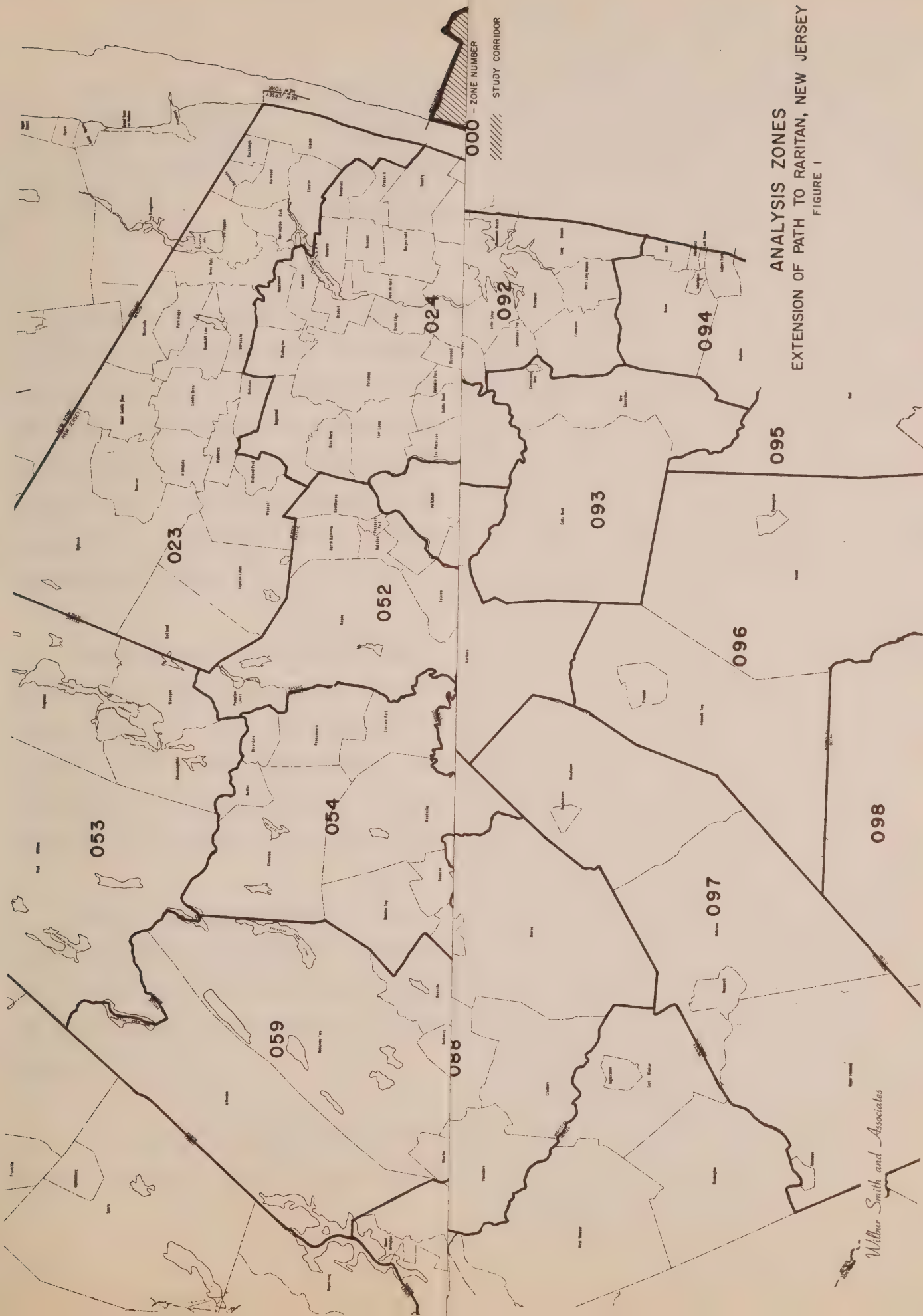
The market area for intra-New Jersey travel consists of all of the above northern New Jersey municipalities described for the trans-Hudson market, as well as Newark, Harrison, Jersey City and Bayonne.

Since Newark Airport serves a regional market, the air passenger market area for these travelers constitutes the entire New York metropolitan area. Figure 1 presents the 99 analysis zones used in the study and identifies the expanded study corridor. Zone configuration generally follows municipal boundaries or groups of municipalities with finer areal detail in certain areas of the corridor.

Proposed PATH Extension Operational Assumptions

If extended to Raritan, an additional 31.6 miles of operating track would be added to the existing PATH system. A shorter extension to Dunellen adds 21.8 miles to PATH rail services.

In addition to existing PATH stations, proposed station stops encompass most of the existing CNJ mainline and "Scoot" stations, with new stations provided at North Elizabeth, Newark Airport and South Street in Newark. Nineteen listed new stations between Newark and Raritan would be added to the PATH system:



ANALYSIS ZONES
EXTENSION OF PATH TO RARITAN, NEW JERSEY
FIGURE 1



LEGEND
000 - ZONE NUMBER
STUDY CORRIDOR

ANALYSIS ZONES
EXTENSION OF PATH TO RARITAN, NEW JERSEY
FIGURE I

South Street	Garden State Parkway	Plainfield
Newark Airport	Cranford	Grant Avenue
North Elizabeth	Garwood	Dunellen
Elmora Avenue	Westfield	Bound Brook
Roselle	Fanwood	Manville
Elizabeth	Netherwood	Somerville
		Raritan

Fares - To facilitate patronage forecasts, the fare structure for the PATH system has been divided into six zones, with Zones 1, 2, and 3 consistent with the previous extension plan. Zone 1 includes all New York and Jersey City stations, and Harrison; Zone 2, being the Newark and South Street stations; and Zone 3, Newark Airport. Zone 4 constitutes stations from North Elizabeth to Westfield; Zone 5, Fanwood to Dunellen; Zone 6, being comprised of Bound Brook through Raritan stations.

Fare levels on the CNJ were used as a guide in preparing the proposed PATH fares, shown in Table 1. These are somewhat higher on a relative basis than existing CNJ commutation charges, as of June, 1971 (prior to the fare increase). Because non-commutation rates were not included in the development of forecasting models, patronage estimates for the PATH system are considered conservative.

Operating Schedules - Since many scheduling alternatives for the extended PATH system are possible, headways, running times, and station stops were assumed solely to permit patronage estimates to be made. It is recognized that further studies of alternative train scheduling are required.

All trains on the proposed extension to Raritan would provide direct service to the World Trade Center in Manhattan from terminals

Table 1

PROPOSED FARES FOR PATH EXTENSION TO RARITAN, NEW JERSEY

ORIGIN ZONE	ONE-WAY FARES TO ZONES:					
	<u>1</u>	<u>2</u>	<u>3</u> (dollars)	<u>4</u>	<u>5</u>	<u>6</u>
1. New York and Jersey City	\$0.30	\$0.30	\$0.60	\$0.90	\$1.10	\$1.30
2. Newark Area	0.30	0.30	0.60	0.60	0.80	1.00
3. Newark Airport	0.60	0.60		0.60	0.80	1.00
4. North Elizabeth to Westfield	0.90	0.60	0.60	0.30	0.45	0.60
5. Fanwood to Dunellen	1.10	0.80	0.80	0.45	0.30	0.45
6. Bound Brook to Raritan	\$1.30	\$1.00	\$1.00	\$0.60	\$0.45	\$0.30

Note: Intra-zone one-way fare is \$0.30.

Source: Louis T. Klauder and Associates.

at Newark, Newark Airport, Westfield and Raritan. Assumed headways for the various segments of the line are:

<u>LINE SEGMENT</u>	<u>PEAK-HOUR HEADWAYS</u> (minutes)	<u>OFF-PEAK HEADWAYS</u> (minutes)
Newark and east	3	10
Newark Airport	6	10
North-Elizabeth-Westfield	12	20
Fanwood-Raritan	18	30

Alternative trains from Raritan would operate express between Westfield and Newark during peak periods.

Running Times - The estimated accumulated running times used for off-peak analyses for the extended portion of PATH are shown in Table 2. Run "A" represents the assumed off-peak operation, with Runs "B" and "C", the two peak period travel time alternatives, for persons boarding west of Cranford. During off-peak periods, with only local service provided, the PATH travel time between Raritan and Newark is assumed to be 53 minutes. With trains alternating between "express" (Run B) and "skip-stop" (Run C) service during peak periods, average travel times for persons boarding PATH facilities west of Cranford would be 7 to 12 minutes less, compared to off-peak periods. With only local service provided on trains originating at terminals east of Raritan during peak periods, travel times would be the same as those shown in Run A for these stations.

For stations west of Cranford, peak period travel times would be, on the average, 6 to 9 minutes less than existing CNJ times. For stations east of Westfield, running times are calculated slightly higher than currently provided by the CNJ. Not reflected in these

Table 2

ASSUMED PATH RARITAN EXTENSION RUNNING TIMES

<u>STATION</u>	<u>ACCUMULATED TIME FROM NEWARK (Minutes)</u>		
	<u>Run 'A'</u>	<u>Run 'B'</u>	<u>Run 'C'</u>
Newark	0	0	0
South Street	1.6	-	1.6
Newark Airport	5.7	-	5.7
North Elizabeth	7.9	-	7.9
Elizabeth	11.1	-	11.1
Elmora Avenue	13.3	-	13.3
Roselle	16.0	-	16.0
Garden State Parkway	18.6	-	18.6
Cranford	20.6	-	20.6
Garwood	23.0	-	-
Westfield	25.4	12.8	24.0
Fanwood	28.7	16.6	27.3
Netherwood	31.2	19.1	-
Plainfield	33.7	21.6	31.0
Grant Avenue	36.0	24.0	-
Dunellen	39.0	26.9	34.9
Bound Brook	44.1	32.0	40.0
Manville	47.8	35.7	-
Somerville	50.8	38.8	45.3
Raritan	53.2	41.1	47.7

Notes: Travel time between Newark and the World Trade Center is 18.5 minutes.

Travel time between Newark and 33rd Street is 28 minutes.
 Run 'A' reflects typical off-peak travel times.
 Runs 'B' and 'C' are alternative peak period travel times
 for trains operating west of Cranford.

Source: Louis T. Klauder and Associates.

figures is the 4- to 5-minute transfer time savings resulting from the elimination of the Newark transfer for trans-Hudson PATH passengers.

Summary of Cranford Extension Forecasts

Forecasts for several alternative conditions were made during the initial phase of this study for a more limited extension of PATH services to Cranford, New Jersey. Table 3 presents revised Cranford extension average weekday ridership estimates comprising all four market segments for the following combinations:

1. Three airport system (no New Jersey STOLport), without Carey Coach;
2. Three airport system, with Carey Coach;
3. Four airport system (includes a New Jersey STOLport not served by PATH), with Carey Coach; and,
4. Four airport system, with Carey Coach and a \$0.50 per person charge on the ITT system.

These estimates have been revised to reflect "average weekday" rather than "average daily" airport passenger travel shown in the Cranford extension engineering report. Average weekday ridership consists of travel during all weekdays for the entire year divided by 260 (the approximate number of annual weekdays). Average daily is the composite of travel during all weekdays and weekends during the entire year divided by 365. In addition, forecasts of Airport visitor usage of the PATH extension, not shown in the previous report, is included in Table 3. In making these estimates, discontinuation of CNJ main-line service was not assumed.

As shown in Table 3, the maximum number of average weekday one-way person trips that begin or terminate at one of the new PATH stations is estimated to be 17,400 by 1985, assuming a three airport system

Table 3

REVISED ESTIMATES OF AVERAGE WEEKDAY
CRANFORD EXTENSION RIDERSHIP

ALTERNATIVE ⁽¹⁾	ESTIMATED ONE-WAY PERSON TRIPS ⁽²⁾	
	1980	1985
1. Three Airport System (no New Jersey STOLport), without Carey Coach	14,895	17,430
2. Three Airport System, with Carey Coach	14,170	16,460
3. Four Airport System (includes New Jersey STOLport), with Carey Coach	13,365	15,400
4. Four Airport System, with Carey Coach and Inter-Terminal Transit Charge	13,220	15,215

(1) Alternatives 1-3 assume no I.T.T. Charge at Newark Airport.

(2) Revised to reflect average weekday versus average daily airport passenger travel shown in the Cranford extension engineering report. Also included are anticipated airport visitor trips which were not shown in this previous report. "Average daily" is total annual travel during weekends and weekdays divided by 365. "Average weekday" is total travel during all weekdays during the year divided by 260 (the approximate number of annual weekdays).

and no Carey Transportation Company bus competition between Manhattan and the Airport. The lowest ridership estimate is 13,200 weekday PATH riders forecast in 1980 for Alternative 4. These ridership figures are for one-way trips such that each direction of a two-way trip is shown as a separate ride on the PATH system.

Newark Airport PATH Patronage for Raritan Extension

A potential market for the PATH extension comprises air travelers, visitors and employees oriented to Newark Airport. Excluding transfer passengers, in 1967, there were approximately 13,000 daily air passengers enplaning and deplaning at the Airport. From the 1967-1968 domestic in-flight survey, conducted by the Port of New York Authority, approximately 59 per cent of the departing air passengers arrived at the Airport by automobile, 12 per cent by taxis, 22 per cent by buses, and approximately 4 per cent by suburban limousine services, given in Table 4. Similar modal split patterns for arriving air passengers are suggested by other studies.

Air Passengers - In comparing ridership forecasts for the PATH extension terminating at Raritan versus Cranford, the Newark Airport air passenger, visitor, and employee markets are least affected. An increase in air passenger patronage of less than six per cent is estimated when PATH is extended beyond Cranford to Raritan.

Total estimated PATH ridership generated by Newark Airport air passengers for 1980 and 1985 are shown in Tables 5 and 6 for the two forecast years, respectively. These forecasts assume no New Jersey STOLport and discontinuation of Carey Transportation Company bus competition to the Airport. With public transportation substantially more competitive with automobile modes for areas east of the Hudson

Table 4

ORIGIN OF PASSENGERS DEPARTING BY AIR FROM NEWARK AIRPORT
BY MODE OF GROUND TRANSPORTATION TO AIRPORT ⁽¹⁾

1967

ORIGIN	DEPARTING DAILY PASSENGERS	MODE OF GROUND TRANSPORTATION						
		Auto	Airport			Limou- sine	Public Bus	Other
			Taxi	Coach				
(per cent of passengers)								
<u>East of Hudson</u>								
Manhattan	1,819	20	17	41	3	16	3	
Brooklyn ⁽²⁾	88	-	-	-	-	-	-	
Other ⁽²⁾	296	-	-	-	-	-	-	
Subtotal	2,203	26	15	37	4	15	3	
<u>West of Hudson</u>								
Union	667	79	11	-	7	3	-	
Essex	701	72	19	1	3	5	-	
Hudson	216	75	21	-	1	3	-	
Richmond ⁽²⁾	101	-	-	-	-	-	-	
Bergen	627	84	6	-	8	2	-	
Passaic ⁽²⁾	209	-	-	-	-	-	-	
Morris	418	75	8	2	10	1	4	
Somerset ⁽²⁾	135	-	-	-	-	-	-	
Middlesex	357	86	8	-	2	4	-	
Monmouth	337	73	7	-	3	12	5	
Orange-Rockland ⁽²⁾	87	-	-	-	-	-	-	
Subtotal	3,855	79	11	-	5	4	1	
<u>Outside</u>								
Metropolitan Area	681	59	9	4	2	18	8	
TOTAL	6,739	59	12	13	4	9	3	

(1) Excludes transfer passengers.

(2) Based on too few cases to merit estimation.

SOURCE: Port of New York Authority, Aviation Economics Division.

Table 5

ESTIMATED NUMBER OF NEWARK AIRPORT
AIR PASSENGERS USING PATH
Raritan Extension
Three Airport System, Without Carey Coach

ORIGIN/ DESTINATION	1980 FORECAST YEAR			
	Estimated Annual Air Passengers (1) (thousands)	Estimated Per Cent Using PATH	Estimated Average Weekday PATH Users (2)	Estimated Annual PATH Users (thousands)
<u>East of Hudson</u>				
Manhattan	3,120	24.4	2,380	764
Downtown	(190)	(61.5)	(370)	(118)
Midtown	(2,020)	(23.6)	(1,475)	(474)
Uptown	(910)	(18.9)	(535)	(172)
Brooklyn	280	43.5	380	122
Other	<u>1,005</u>	<u>6.7</u>	<u>210</u>	<u>68</u>
Subtotal	4,405	21.6	2,970	954
<u>West of Hudson</u>				
Union	1,020	10.8	340	110
Essex	880	3.1	85	25
Hudson	295	6.3	55	20
Richmond	190	-	-	-
Bergen	1,330	-	-	-
Passaic	410	-	-	-
Morris	760	-	-	-
Somerset	415	9.6	125	40
Middlesex	800	3.1	75	25
Monmouth	915	4.0	115	35
Orange-Rockland	390	-	-	-
Subtotal	<u>7,405</u>	<u>3.3</u>	<u>795</u>	<u>260</u>
TOTAL	11,810	10.3	3,765	1,214

(1) Provided by Port of New York Authority, Aviation Economics Division.

(2) Previous report shows average day rather than average weekday PATH users in this column.

NOTE: Numbers in parentheses are included in "Manhattan totals."

Table 6

ESTIMATED NUMBER OF NEWARK AIRPORT
AIR PASSENGERS USING PATH

Raritan Extension

Three Airport System, Without Carey Coach

ORIGIN/ DESTINATION	1985 FORECAST YEAR			
	Estimated Annual Air Passengers (1) (thousands)	Estimated Per Cent Using PATH	Estimated Average Weekday PATH Users (2)	Estimated Annual PATH Users (thousands)
<u>East of Hudson</u>				
Manhattan	4,520	24.0	3,380	1,075
Downtown	(270)	(61.5)	(520)	(166)
Midtown	(2,885)	(23.1)	(2,090)	(670)
Uptown	(1,365)	(18.0)	(770)	(246)
Brooklyn	395	43.5	535	172
Other	1,475	7.2	330	106
Subtotal	6,390	22.8	4,245	1,353
<u>West of Hudson</u>				
Union	1,405	10.5	460	147
Essex	1,230	2.8	110	35
Hudson	410	6.7	85	25
Richmond	265	-	-	-
Bergen	1,845	-	-	-
Passaic	565	-	-	-
Morris	1,050	-	-	-
Somerset	570	9.1	165	53
Middlesex	1,110	2.9	105	32
Monmouth	1,265	4.0	160	50
Orange-Rockland	545	-	-	-
Subtotal	10,260	3.3	1,085	342
TOTAL	16,650	10.2	5,330	1,695

(1) Provided by Port of New York Authority, Aviation Economics Division.

(2) Previous report shows average day rather than average weekday PATH users in this column.

NOTE: Numbers in parentheses are included in "Manhattan Totals."

River, from 75 to 80 per cent of Airport passenger PATH riders are expected to have origins and destinations in New York City. For the three airport system, without Carey Coach service, of the total 11.8 million annual air passengers forecast for 1980, 1.2 million passengers are expected to use PATH for Airport access or egress, resulting in 3,765 average weekday one-way PATH rides. By 1985, comparable volumes are 1.7 million annual, and 5,330 weekday PATH one-way trips. At that time, total annual patronage at Newark Airport has been forecast by the Port of New York Authority to be 16.6 million passengers.

For other assumed conditions, fewer passengers are expected, with estimates of 4,450 and 3,610 average weekday riders forecast in 1985, for the three airports, with Carey Coach; and four airports with Carey Coach conditions, respectively. Forecasts for the various combinations are summarized in Table 7.

Airport Visitors - Although conventionally, airport visitors comprise a major portion of the total daily population at an airport, relatively few persons from this category can be considered potential PATH users. Most visitors at an airport are there to provide transportation or best wishes for air passengers. In estimating ridership, a ratio of 0.10 visitor to an airport passenger is assumed for the PATH system on weekdays, with a slightly higher ratio applicable on weekend days.

The visitor-to-passenger ratio used in the Kennedy Airport Access Project was about 50 per cent of that assumed here. By comparison, visitor usage of the Cleveland Airport rail access system in 1969 was considerably higher than this figure. However, more

Table 7

SUMMARY OF ESTIMATED NEWARK AIRPORT AIR PASSENGERS USING PATH
Raritan Extension

ALTERNATIVE	1980 FORECAST YEAR				1985 FORECAST YEAR			
	Estimated Annual Air Passengers ⁽¹⁾ (thousands)	Estimated Air Passenger One-way PATH Trips			Estimated Annual Air Passengers ⁽¹⁾ (thousands)	Estimated Air Passenger One-way PATH Trips		
		Average Annual Weekday (thousands)	Average ⁽²⁾ Weekday (thousands)	Per Cent		Average Annual Weekday (thousands)	Average ⁽²⁾ Weekday (thousands)	Per Cent
1. Three Airport System, without Carey Coach	11,810	1,215	3,765	10.3	16,650	1,695	5,330	10.2
2. Three Airport System, with Carey Coach	11,810	1,005	3,140	8.5	16,650	1,425	4,450	8.6
3. Four Airport System, with Carey Coach	9,910	795	2,480	8.0	14,100	1,155	3,610	8.2

(1) Provided by Port of New York Authority, Aviation Economics Division

(2) Previous report shows average day rather than average weekday PATH trips in this column.

recent data suggest that some of this visitor travel can be attributed to the "newness" or novelty of the Cleveland service.

Using the assumed ratio for the three airport system without Carey Coach, by 1980 it is estimated about 375 one-way visitor trips will be made on the PATH system each weekday. Approximately 530 one-way visitor trips per weekday can be expected by 1985. These include persons accompanying air passengers, as well as casual and business visitors to the Airport.

Airport Employees - With no New Jersey STOLport in 1980, about 6,500 employees are forecast to be working at Newark Airport on weekdays. Of these, 3,300 will work in Airport locations conveniently served by the PATH extension. Approximately two-thirds of these are ground employees, the others being flight personnel. If no charge is made on the ITT system, a total of 1,020 one-way PATH trips by employees are estimated on an average weekday. Under the same conditions, by 1985, approximately 1,290 employee trips are estimated on PATH each weekday. A total weekday employee force of 8,500 persons is forecast at this time.

For other test conditions, fewer employee trips are expected. Assuming a four airport system, approximately 875 employee trips are forecast each weekday by 1980, with no additional fare charged on the ITT system. At this time, the total weekday employee force at Newark Airport is expected to be 5,600 persons. By 1985, for these same conditions, 1,030 trips by employees are forecast on PATH on an average weekday.

Trans-Hudson Travel

When comparing projected PATH ridership for the various market segments, it is estimated that the largest volume of travel on extended PATH will be made by trans-Hudson travelers.

With regard to existing trans-Hudson travel, 1968 Port Authority surveys show that about 54,000 one-way person trips were made between the expanded study corridor and New York on an average weekday. Over half of this travel occurred during the 6:00-to-10:00 A.M. and 4:00-to-7:00 P.M. peak periods. Table 8 shows the distribution of trans-Hudson travel by mode and time period for the study corridor at that time. On an average weekday, 58 per cent of persons making trips used public transportation, with about 85 per cent of peak period travelers using public transportation modes. During non-peak hours, substantially greater use was made of the private automobile, with 69 per cent of all trips made by this mode.

Of the public transportation trips, the two trans-Hudson rail services (PATH and Penn Central Railroad) served about two-thirds of the total transit travel, the remainder using buses. Approximately 11,000 one-way rides were made by persons within the study corridor on the PATH system during an average weekday. About 72 per cent of these were CNJ passengers who transferred between PATH and the CNJ at Newark. Most of the remaining PATH trips from the study area were made by persons who transferred between the Penn Central or Erie Lackawanna Railroads and PATH.

The predominant destination of PATH trips was downtown Manhattan, with over 70 per cent of trans-Hudson PATH riders from the study corridor having origins or destinations in this area.

Table 8

TRANS-HUDSON PERSON TRIPS BY MODE,
 Raritan Extension Market Area ⁽¹⁾

1968

MODE	AVERAGE WEEKDAY ONE-WAY PERSON TRIPS	
	Number	Per Cent
<u>Peak Period ⁽²⁾</u>		
Auto	4,005	14.6
Bus	6,280	23.0
Rail Modes		
PATH	9,215	33.7
Other Rail	<u>7,835</u>	<u>28.7</u>
Subtotal	<u>17,050</u>	<u>62.4</u>
TOTAL	27,335	100.0
<u>Non-peak Period</u>		
Auto	18,400	69.4
Bus	4,575	17.2
Rail Modes		
PATH	1,700	6.4
Other Rail	<u>1,845</u>	<u>7.0</u>
Subtotal	<u>3,545</u>	<u>13.4</u>
TOTAL	26,520	100.0
GRAND TOTAL	53,855	
Total PATH Trips:		
Average Weekday	10,915	
Annual	3,100,000	

(1) Potential market area includes all of Union County except Rahway, New Providence, Summit, and Berkeley Heights; all of Somerset County with the exception of Bernards, Bedminster, Far Hills, Bernardsville, and Peapack Gladstone; as well as Dunellen, Middlesex, South Plainfield, and Piscataway in Middlesex County.

(2) Includes trips made during 6:00 to 10:00 A.M. and 4:00 to 7:00 P.M. in major direction of travel only.

SOURCE: Port of New York Authority, 1968 Trans-Hudson Origin and Destination Surveys.

In addition to providing connecting services to the PATH system, the CNJ mainline served about 3,300 average weekday trans-Hudson passengers transferring between the CNJ and Penn Central Railroad at Newark.

Estimated Future Trans-Hudson Travel - In the future, for persons oriented to Midtown Manhattan, the PATH uptown branch will provide a better option to persons in the study corridor than today. Currently, when CNJ eastbound passengers arrive at Newark, their rail alternatives to Midtown Manhattan are PATH uptown or the Penn Central Railroad. Penn Central travel time to Penn Station is 15 to 16 minutes compared to 27 to 28 minutes to 33rd Street via PATH. Additionally, the PATH trip requires a second transfer at Journal Square.

With PATH replacing the CNJ, the travel time difference is still seven minutes greater via PATH due to elimination of the second transfer. PATH one-way fares to Midtown are \$0.28 less than the Penn Central monthly commutation fare and a substantial portion of passengers boarding PATH west of Newark are expected to be diverted from the Penn Central Railroad to Midtown Manhattan. This will result in additional emphasis on Journal Square versus Newark Terminal for these former CNJ riders.

Based on trans-Hudson trip files and Port of New York Authority population and employment projections for the study corridor in 1980, it is estimated about 59,700 one-way trans-Hudson person trips will be made on an average weekday. In 1985, it is expected this number will escalate to around 63,700 one-way trips. Tables 9 and 10 summarize the estimated average weekday person trips by mode for 1980 and 1985, respectively.

Table 9

ESTIMATED TRANS-HUDSON PERSON TRIPS BY MODE
 Raritan Extension Market Area ⁽¹⁾

1980 Forecast

MODE	AVERAGE ONE-WAY WEEKDAY PERSON TRIPS			
	Peak Period (2)		Non-Peak Period	
	Number	Per Cent	Number	Per Cent
Auto	4,200	13.5	19,275	67.0
Bus	8,390	27.1	4,965	17.3
Rail Modes				
PATH Direct	(11,055)	(35.7)	(2,900)	(10.1)
PATH + Penn Central	(1,345)	(4.4)	(275)	(1.0)
Subtotal PATH	12,400	40.1	3,175	11.1
Penn Central Direct	(4,595)	(14.8)	(1,130)	(3.9)
Other Rail + PATH	(1,410)	(4.5)	(220)	(0.7)
Subtotal Other Rail	6,005	19.3	1,350	4.6
Total Rail	18,405	59.4	4,525	15.7
TOTAL	30,995	100.0	28,765	100.0

Total PATH Extension Trips:

Average Weekday	15,575
Annual	4,410,000

- (1) Potential market area includes all of Union County except Rahway, New Providence, Summit, and Berkeley Heights; all of Somerset County with the exception of Bernards, Bedminster, Far Hills, Bernardsville, and Peapack Gladstone; as well as Dunellen, Middlesex, South Plainfield and Piscataway in Middlesex County.
- (2) Includes trips made during 6:00 to 10:00 A.M. and 4:00 to 7:00 P.M. in major direction of travel, only.

Table 10

ESTIMATED TRANS-HUDSON PERSON TRIPS BY MODE
 Raritan Extension Market Area ⁽¹⁾
 1985 Forecast

MODE	AVERAGE ONE-WAY WEEKDAY PERSON TRIPS			
	Peak Period ⁽²⁾		Non-Peak Period	
	Number	Per Cent	Number	Per Cent
Auto	4,415	13.4	20,435	67.0
Bus	8,950	27.1	5,245	17.2
Rail Modes				
PATH Direct	(11,870)	(35.8)	(3,100)	(10.2)
PATH + Penn Central	(1,425)	(4.3)	(295)	(1.0)
Subtotal PATH Extension	13,295	40.2	3,395	11.2
Penn Central Direct	(4,900)	(14.7)	(1,185)	(3.9)
Other Rail + PATH	(1,525)	(4.5)	(235)	(0.7)
Subtotal Other Rail	6,425	19.3	1,420	4.6
Total Rail	19,720	59.5	4,815	15.8
TOTAL	33,185	100.0	30,495	100.0

Total PATH Extension Trips:

Average Weekday	16,690
Annual	4,673,200

-
- (1) Potential market area includes all of Union County except Rahway, New Providence, Summit, and Berkeley Heights; all of Somerset County with the exception of Bernards, Bedminster, Far Hills, Bernardsville, and Peapack Gladstone; as well as Dunellen, Middlesex, South Plainfield, and Piscataway in Middlesex County.
- (2) Includes trips made during 6:00 to 10:00 A.M. and 4:00 to 7:00 P.M., in major direction of travel only.

An increase in the proportion of bus usage during peak periods is expected in the future resulting from several analysis assumptions. Two factors, being travel time and reliability of service improvements due to the peak-period Lincoln Tunnel express bus lane operation, affect this. Further, with CNJ service to Newark replaced by the PATH extension, for persons boarding east of Westfield, weighted average rail travel times and costs to Midtown Manhattan reflect a less competitive service than the existing CNJ-to-Penn Central alternative. This results from the increased travel time to Newark via PATH versus CNJ combined with a higher travel cost.

On the average, a total of 15,575 one-way person trips are estimated to be made on extended PATH during weekdays by 1980 by trans-Hudson passengers. This represents approximately 4.4 million annual PATH rides. By 1985, almost 4.7 million one-way trips are expected annually, resulting in an estimated 16,700 one-way rides each weekday. Further, it is estimated that about 90 per cent of the trans-Hudson passengers boarding the extension west of Newark will avoid the transfer to Penn Central at Newark by continuing their journey on PATH. Of the remaining rail passengers, approximately 5,700 one-way trips are expected to be made by 1980 using Penn Central directly between Manhattan and the study corridor, with about 1,600 transfers between Penn Central and Erie Lackawanna Railroads and PATH on an average weekday.

Intra-New Jersey Travel

An additional segment of potential travel for extended PATH comprises intra-New Jersey trips. Tri-State data developed from the 1963-1964 home interview survey indicate that 96,700 person trips were made on an average weekday within the expanded study corridor. This

figure does not include intra-zonal travel or zone-pairs for which the PATH extension is not considered competitive with alternative modes.

Approximately 81 per cent of these trips were by automobile, as given in Table 11. This compares with about 14 per cent using bus and 5 per cent using rail facilities. However, not represented by these figures are significant changes in rail and bus services transpiring since 1963. They include (1) improvements in CNJ operations, resulting from implementation of the Aldene Plan, and (2) reduction in the frequency of bus service provided on most of the Public Transport of New Jersey (formerly Public Service) bus lines.

Based on 1970 station boarding volumes and trans-Hudson and intra-New Jersey trip files, it appears that of the total 17,500 weekday CNJ mainline passengers, approximately 6,500 to 7,000 are traveling within the State of New Jersey. Additionally, these data suggest that approximately 67 per cent of the CNJ intra-New Jersey passengers have origins or destinations in Newark, the remainder distributed to other communities within the State.

Estimated Future Intra-New Jersey PATH Travel - For the intra-New Jersey market, modal split models were again used to estimate projected travel. However, because of limitations in travel time and cost networks, as well as insufficient analysis zone detail, these models were not used in projecting PATH ridership in areas of the study corridor west of Cranford. Instead, base year trip interchange and modal split data were compared with 1970 CNJ boarding volumes to estimate projected PATH ridership. CNJ boarding volumes were also compared with modeling results for the corridor east of Cranford with a three per cent overall reduction made to projected rail volumes.

Table 11

INTRA-NEW JERSEY PERSON TRIPS BY MODE

Raritan Extension Market Area ⁽¹⁾

1963

MODE	AVERAGE WEEKDAY ONE-WAY PERSON TRIPS ⁽²⁾	
	Number	Per Cent
<u>Work Trips</u>		
Auto	46,120	80.0
Bus	8,215	14.2
Rail Modes	3,315	5.8
TOTAL	57,650	100.0
<u>Non-Work Trips</u>		
Auto	31,890	81.7
Bus	5,675	14.5
Rail Modes	1,485	3.8
TOTAL	39,050	100.0
GRAND TOTAL	96,700	

(1) Includes Newark, Harrison, Jersey City, and Bayonne; all of Union County except Rahway, New Providence, Summit, and Berkeley Heights; all of Somerset County except Bernards, Bedminster, Far Hills, Bernardsville, and Peapack Gladstone; as well as Dunellen, Middlesex, South Plainfield and Piscataway in Middlesex County.

(2) Only trips between various origins and destinations that could potentially be attracted to the PATH extension are shown.

Summaries of total projected one-way person trips for work and non-work purposes by the intra-New Jersey market segment are presented in Table 12, for 1980 and 1985. Approximately 124,000 one-way person trips by all modes, on an average weekday, are estimated by 1980. This number is expected to increase to approximately 132,000 by 1985. Continued usage of the private automobile by most persons is expected in the future with over 80 per cent of all forecast trips made by private modes. For work trip purposes, it is expected rail and bus usage will be split about even, with approximately 10 per cent using each mode. With more dispersed origins and destinations, and relative service advantages for non-work purposes, approximately twice as many persons are expected to use bus than rail.

By 1980, it is estimated about 8,750 one-way trips on the PATH extension will be made each weekday by this market segment, with 9,320 forecast for 1985. This results in approximately 2.5 million annual PATH extension trips by 1980 and 2.6 million by 1985.

Summary of Estimated PATH Extension Patronage

A summary of projected one-way person trips on an average weekday, comprising all of the market segments of the PATH extension, is presented in Table 13. The maximum number of additional one-way rides forecast is 33,165 by 1985, assuming no Carey Bus service and a three airport system. Ridership figures for other assumed airport conditions are somewhat lower, with about 28,000 daily person trips estimated by 1980 for the four airport system, with Carey Coach competition being the lowest forecast.

Projected Line and Station Volumes - Allocation of total forecast travel to the proposed physical rail system (extended PATH) has

Table 12

ESTIMATED INTRA-NEW JERSEY PERSON TRIPS BY MODE
Raritan Extension Market Area ⁽¹⁾

1980-1985

MODE	AVERAGE WEEKDAY ONE-WAY PERSON TRIPS ⁽²⁾			
	1980		1985	
	Number	Per Cent	Number	Per Cent
<u>Work Trips</u>				
Auto	57,085	80.2	60,430	80.2
Bus	6,885	9.7	7,285	9.7
Rail Modes				
PATH	5,965	8.4	6,305	8.4
Other Rail	1,190	1.7	1,265	1.7
Subtotal	7,155	10.1	7,570	10.1
TOTAL	71,125	100.0	75,285	100.0
<u>Non-Work Trips</u>				
Auto	43,420	82.1	45,830	82.0
Bus	6,420	12.1	6,785	12.1
Rail Modes				
PATH	2,805	5.3	3,015	5.4
Other Rail	240	0.5	280	0.5
Subtotal	3,045	5.8	3,295	5.9
TOTAL	52,885	100.0	55,910	100.0
GRAND TOTAL	124,010		131,195	

Total PATH Extension Trips:

Average Weekday	8,770	9,320
Annual	2,455,600	2,609,600

- (1) Includes Newark, Harrison, Jersey City, and Bayonne; all of Union County except Rahway, New Providence, Summit, and Berkeley Heights; all of Somerset County except Bernards, Bedminster, Far Hills, Bernardsville, and Peapack Gladstone; as well as Dunellen, Middlesex, South Plainfield and Piscataway in Middlesex County.
- (2) Only trips between various origins and destinations that could potentially be attracted to the PATH extension are shown.

Table 13

SUMMARY OF ESTIMATED AVERAGE WEEKDAY
PATH EXTENSION RIDERSHIP

Raritan Extension

ALTERNATIVE (1)	FORECAST YEAR	
	1980	1985
1. Three Airport System, without Carey Coach	29,505	33,165
2. Three Airport System, with Carey Coach	28,820	32,195
3. Four Airport System, with Carey Coach	27,950	31,010

(1) Includes travel by all market segments.

given projected line and station volumes. These assignments are presented in Figures 2 through 5. Station volumes shown include boarding and alighting passenger movements, with line volumes being the sum of one-way travel in both directions. Additionally, only trips with at least one trip-end at one of the new PATH stations are shown as assigned traffic. These passenger assignments do not reflect possible limits in parking space supply at the various stations, or possible impacts of park-ride facilities other than at the proposed Garden State Parkway park-ride lot.

Average weekday line and station volumes estimated by 1980 are shown in Figure 2. These numbers assume the three airport system, without Carey Coach, for which a total of 29,500 average weekday one-way trips are forecast. The largest line volume (maximum load point) occurs between Newark and South Street stations, with approximately 25,900 PATH riders estimated through this segment each weekday. With all of the trans-Hudson travelers, most of the airport related passengers, and the majority of intra-New Jersey PATH extension riders estimated to pass through this segment, almost 88 per cent of the total forecast PATH trips are represented by this number. The largest station volume occurs at the World Trade Center (Hudson Terminal) with approximately 10,600 one-way passenger trips each weekday (about 5,300 boarding and 5,300 alighting passengers). Average weekday volumes at Newark Station are estimated to be 7,700 one-way person trips by 1980. Stations with volumes less than 500 movements per weekday include Manville, Grant Avenue, Garwood, and North Elizabeth.

Figure 3 shows estimated average weekday riders by 1985 for the same airport assumptions. Again, the maximum load point occurs between Newark and South Street station, with approximately 28,600 passengers

forecast through this segment each weekday. On an average weekday, passengers generated from the study corridor entering and exiting Hudson Terminal represent approximately 11,800 one-way person trips. Estimated Newark Airport station volume is 7,200 one-way person trips, with about 8,500 one-way trips expected to be made by persons oriented to Newark Station.

Estimates of morning and afternoon peak hour line and station volumes expected by 1985 during an average weekday are shown in Figures 4 and 5. With relatively low peaking characteristics expected for Newark Airport air passengers and employees during the morning (8:00 to 9:00 A.M.) and afternoon (5:00 to 6:00 P.M.) hours, almost all of the assigned traffic represents non-airport related travel. Travel for work purposes accounts for most of the trips shown for both peak periods, with nearly all morning peak hour travel on extended PATH contemplated to be made by trans-Hudson and intra-New Jersey commuters.

As shown in Figure 4, major destination stations during the morning peak hour are the various Manhattan PATH stations, totaling over 5,000 one-way passenger trips; and Newark station, with approximately 1,800 forecast trips. Major origin stations are Cranford, Westfield, Fanwood and Plainfield, with numbers ranging from 650 to 1,500 morning peak hour boarding passengers estimated at each station in 1985. For the afternoon peak hour (Figure 5), assigned volumes approximate the morning peak hour, with the expected reversal in direction of travel shown.



EXTENSION OF PORT AUTHORITY TRANS HUDSON
RAIL SYSTEM TO RARITAN, NEW JERSEY

ESTIMATED AVERAGE WEEKDAY RIDERS
FORECAST YEAR 1985
Three Airport System, Without Carey Coach

FIGURE 3



EXTENSION OF PORT AUTHORITY TRANS HUDSON RAIL SYSTEM TO RARITAN, NEW JERSEY

ESTIMATED MORNING PEAK HOUR RIDERS (8:00-9:00A.M.)
FORECAST YEAR 1985
Three Airport System, Without Carey Coach

FIGURE 4



EXTENSION OF PORT AUTHORITY TRANS HUDSON
RAIL SYSTEM TO RARITAN, NEW JERSEY

ESTIMATED AFTERNOON PEAK HOUR RIDERS (5:00-6:00 P.M.)
FORECAST YEAR 1985
Three Airport System, Without Carey Coach

FIGURE 5

Termination of the PATH Extension at Dunellen

Approximately 3,500 of the projected average weekday PATH trips by 1980 should begin or terminate at stations west of Dunellen. If the PATH system were extended only as far as Dunellen, it is estimated that about 2,100 fewer trips will occur on extended PATH each weekday than forecast for the Raritan extension. Factors considered in making these estimates were travel times and costs by alternative modes, projected origins and destinations, and trip purposes.

By 1985, 4,000 average weekday PATH one-way trips have been estimated to be made by persons oriented to the Raritan, Manville, and Bound Brook stations. When termination of the PATH system is assumed at Dunellen, approximately 60 per cent of these persons are expected to divert to alternative modes. This represents about 2,400 fewer rides on the PATH system during an average weekday than when an extension to Raritan is assumed. For passengers estimated not to divert to alternative modes when the shorter extension is assumed, about 61 per cent are expected to be making trans-Hudson trips, 32 per cent intra-New Jersey trips, with the remaining 7 per cent oriented to Newark Airport.

Comparison of Patronage Forecasts

By 1985, when a three airport system and no Carey Coach competition are assumed, 33,165 average weekday one-way riders are forecast for the Raritan extension. Under the same assumptions, the number of average weekday riders is estimated to be 30,750 and 17,430 for PATH extensions to Dunellen and Cranford, respectively. Annualizing these figures results in the following forecasts:

			ESTIMATED ANNUAL PATH EXTENSION ONE-WAY TRIPS	
			1980	1985
<u>PATH</u>	<u>EXTENSION</u>	<u>TO:</u>	<u>Forecast Year</u>	<u>Forecast Year</u>
	Raritan		8,550,000	9,590,000
	Dunellen		7,790,000	8,720,000
	Cranford		4,380,000	5,160,000

For the PATH extension to Raritan, about one-half of the person trips forecast during weekdays are expected to be made by trans-Hudson travelers. Intra-New Jersey travel should account for approximately 28 per cent, and Newark Airport related travel 22 per cent of the total forecast PATH extension trips. Proportions similar to these are estimated when an extension to Dunellen is assumed.

Although the absolute number of Newark Airport related trips is roughly the same for all three extension alternatives, due to the smaller potential market area for the Cranford extension, and different assumptions regarding CNJ rail competition, a different proportion of travel related to market segments is envisaged. For the Cranford extension, about 38 per cent of the total projected PATH extension travel will likely be oriented to Newark Airport. The proportion of travel for intra-New Jersey and trans-Hudson purposes should be split about even, with each comprising approximately 31 per cent of the total travel.

Estimates of modal split and traffic assignments for conditions without the PATH extension were not performed as part of this study. Although this precluded a detailed analysis of which modes and facilities projected PATH passengers have been diverted from, general estimates based on trend analysis were made.

Over 75 per cent of the forecast PATH Raritan extension riders are expected to be diverted from other rail facilities (most of these being former CNJ mainline passengers). Approximately 12 per cent are expected to be diverted from private auto and taxi, with up to 13 per cent diverted from buses to PATH.

Estimates by market segment of which modes PATH passengers would have used assuming no extension were calculated. These reflect a 1980 condition when no New Jersey STOLport and no Carey Coach competition to Newark Airport are assumed:

<u>MARKET SEGMENT</u>	<u>ESTIMATED NUMBER OF PATH EXTENSION PASSENGERS DIVERTED FROM:</u>			
	<u>Auto</u>	<u>Bus</u>	<u>Other Rail</u>	<u>Total</u>
Air passengers and visitors	1,400	2,750	-	4,150
Airport Employees	875	150	-	1,025
Trans-Hudson	700	-	14,875	15,575
Intra-New Jersey	600	700	7,450	8,750
	<u> </u>	<u> </u>	<u> </u>	<u> </u>
TOTAL	3,575	3,600	22,325	29,500

For air passengers and visitors projected to use PATH, it is expected that two-thirds will have been diverted from buses and one-third from private auto and taxi. Most airport employees projected to use PATH will likely use a private auto if the PATH extension is not provided. Approximately 90 per cent of the projected trans-Hudson and intra-New Jersey PATH extension passengers are expected to have been diverted from other rail facilities.

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